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EVALUATING METHODS OF THE PROJECT SOLUTION EFFECTIVENESS IN INFORMATION SECURITY SYSTEM DEVELOPING BASED ON RESOURCE MAPS

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The article presents methods of quantitative valuation of project decision effectiveness in information security system development.

Keywords: absolute efficiency, relative efficiency, methods, project, resource maps, information security systems, the effectiveness of the project (design) decision.

Problem

Determination of the design decision effectiveness is a non-trivial task. In most cases, the assessment of effectiveness is made subjectively, as a rule on the basis of experts' assessments by known methods. It is based on narrow area experts' opinions in the field of information security and it's not carried out a systematic analysis of the efficiency of decision-making process upon information security system creating.

In most cases, when creating information security systems the rating systems are used. On their basis the calculation of quantitative factor of decision-making process is fulfilled. In practice, such systems are quite specific and often mostly persecute motivational goals than the real purpose.

Indeed, determining the effectiveness of decisions is based on the principle of comparative characteristics of some standard set of actions, decisions or results. But wrong decisions, taken at the design stage, lead to information leakage due to detected during operation protection mechanism vulnerabilities.

Therefore, the search of a common approach to determine the quantitative methods of evaluating the effectiveness of the design decisions during creating information security systems is a challenging problem.

Analysis of research publications and reports

Analysis of research publications and reports confirms that publications describing the procedure for evaluation the effectiveness of the systems is not determined by quantification of total project solutions, and available estimates do not allow us to determine the requirements for information security systems as complex systems.

So in [1-4] there is a general formal approach to the creation of information security systems, but the quantitative evaluation performances of the decision in the design of information security systems have not been revealed.

In [5] there is a common approach to determine the quantitative approach for evaluating the effectiveness of project management, but the peculiarities of information security system design are not defined.

In [6] the requirements for complex systems, which are the systems of information security, are determined. But the problem for the developer is how to take these requirements for information security systems into consideration.

In [7] a general methodology of requirements for information security systems is shown, but it is necessary to define the quality requirements of the decision-making with such approach as resource maps. This approach allows a more careful approach to assessing the quality of the decision.

Thus, the purpose of the article is a method for assessment the effectiveness of project decisions during creating information security systems based on resource maps.

Main part

In design methodology we often use the terms “management efficiency”, “effectiveness of management decisions”. These terms reflect the efficiency of interaction between subsystems and systems that transform inputs into outputs and job management system as a whole. One of the main requirements to management is a quality requirement, that must necessarily be considered from the standpoint of a systematic approach. This requirement involves consideration of quality management system from the standpoint of a higher level inherently complex systems, which are information security system [6].

In [5] it is given an attempt to determine the range of tasks associated with the general approach of determining the effectiveness of complex systems, which indicates the need to partition the concepts of “effect” and “efficiency” and, to the author's view, it is given the correct research vector, where the “effect” should be understood as a result or consequence of certain actions, and “efficiency” – as a property of actions that lead to the effect.

That is the efficiency is determined by some function of several parameters of the system, and the effect – by the integral sum of the function of time.

For project management, as a result of which a quality solution must be formed, we’ll define efficiency, as defined property of management project, which is objectively reflected as the degree of achievement of the objectives’ tree taking into account the cost of resources.

Let’s show the following definitions: properties of information security system - some functional, that combines a set of functions of information security system for their further conversion into function of efficiency. Efficiency function can be built only in a system with adequate control mechanism (e.g. intrusion detection system), which provides an objective assessment of management results. Under the information security systems design management results we have to understand the timely and qualitative implementation of the planned design works with expected quality.

In fact, the efficiency function is a function with delay, as a result of management can be assessed by the certain time only, and therefore it is necessary to further define the mechanism of timely response. The mechanisms of deviation from the expected value range earlier inform stimulation are called preventive self-control mechanisms (5).

Highlighting the above, we can come to the conclusion, that the effectiveness of project management solution is a function of time, which objectively reflects the degree of adequacy between the expectation and the actual state of affairs. This is the essence of performance indicator and determines the nature of the phenomenon.

In practice information security management systems regularly take partial solution to use various security mechanisms, each of them brings its contribution to the final effect.

So, let’s divide the concept of “efficiency of design decisions” on absolute E_a and relative E_r terms.

The absolute indicator E_a means the effectiveness of the decision about extreme limits, for example, a particular phase of work:

$$E_a(t) = f_r \cdot f_q \cdot f_c, \qquad (1)$$

where f_r – resource absorption factor for the mentioned period, which is the ratio of the planned resource to realized resource values; f_q – the quality factor, which characterizes the value of customer responsiveness for the mentioned period; f_c – the completion factor, which characterizes the completion magnitude of the process in relation to the planned project time.

The resource absorption factor plays a key role in making design decisions, its reflection can be found in the method [5], therefore this figure is taken as the main performance indicator in the calculation of the efficiency of design decisions. For example, as a resource the financial costs may be taken, in this case this factor reflects the index of the value:

$$f_r = \frac{C_p}{C_a}, \qquad (2)$$

where C_p – project costs, which are incorporated in the said time t; C_a – actual costs at a specified time t.

In one line with the coefficient of resource absorption is an important indicator of the quality of performed work. In practice, it's not always possible objectively to assess the quality of non-completed works and the results of the performed individual works from the total work. Therefore, in the planning process checkpoints are assigned, which help to check the quality of performed works, as a rule in a percentage.

Completion factor (f_c) considers the degree of completion of the transaction in relation to a given period:

$$f_c = \frac{\tau_p(t) \cdot (T_p + \Delta\tau(t))}{T_p \cdot \tau_a(t)}, \qquad (3)$$

where $\tau_p(t)$ – the total duration of the planned project work for mentioned time (t); $\tau_a(t)$ – the total duration of the actually performed project work on the time (t); T_p – the total duration of all the planned works of the project; $\Delta\tau(t)$ – the factor that characterizes the time change of the project implementation.

In a case when the work or a work package is on the critical path, then this value (factor) is the time difference between actually carried out works and planned ones:

$$\Delta\tau(t) = \tau_a(t) - \tau_p(t). \qquad (4)$$

For example, if the value of the project work is 800 hours, and the complex planned work – 150 hours, and by the time (t) the value factor $\Delta\tau(t) = 230$ hours, then the completion factor of this work package is:

$$f_c = \frac{150 \cdot (800 + (230 - 150))}{800 \cdot 230} = 0.72.$$

This formula reflects the link of two factors: the completion factor as planned $f_{c(plan)}$ and the actual completion factor $f_{c(actual)}$:

$$f_{c(plan)} = \frac{\tau_p(t)}{T_p};$$

$$f_{c(actual)} = \frac{\tau_a(t)}{T_p + \Delta\tau(t)}; \quad (5)$$

$$f_c = \frac{f_{c(plan)}}{f_{c(actual)}}.$$

A relative performance of design decision efficiency E_r means a part of efficiency and its contribution to the overall efficiency of design decision making, which in its turn, is calculated as a part of absolute effectiveness factor of the design decision in general:

$$E_r(t) = E_a(t) \cdot f_i, \quad (6)$$

where $E_r(t)$ – a relative efficiency factor of design decisions; f_i – importance factor or scope of decision, which characterizes the importance of the decision as for the general project.

The importance factor can be defined both by experts and the ratio of two values, one of them determines the scope of impact of made decision and the other a scope of project. For example, if efficiency of project phase management is determined, the project time of mentioned phase realization can be chosen as the first value, and the second value – the project time of a general project implementation:

$$f_i = \frac{T_i}{T_{phase}}, \quad (7)$$

where T_i - the time of implementation of the project; T_{phase} – the time of implementation of the project phase.

In this example, we can determine the phase's budget as the first value, and the second value – the project's budget. The main requirement when determining importance factor is a common scope for the project.

Let's examine the calculating of efficiency of design decision factor as an example (Table 1).

In this table "a type of operations" is classified by the manner, which proposed in [5], where operations are divided into dependent, independent and dependent in small ranges of increasing resource. That is, if for the independent operation of increase resource, 6 man-hours were allocated, then the increase in manpower of performers won't lead to a decrease of the total time of the operation. The column "type of resource allocation capacity" shows the nature of allocation of load on a command of performers during operation.

On the upper part of the Fig. 1, in circles with numbers from 1 to 9, breakpoints of quality control are shown. The circles with list elements (6.1, 8.1) denote additional points to clarify the process of the project. Overlay figures shows planned and actual works of the project, and their volume – the required amount of resources. Also on the right and below the picture, in the form of numerical values, according to intervals, the planned and actual number of resources is reflected.

Table 1.

Project settings

№ з/п	Process	Type of operation	Possible actions	Type of resource allocation capacity	Duration (h-s)	Used resource (monetary unit)
1	Process 1				15	47.5
1.1	Operation 1	Which depends on small range	The increase in intensity; the use of additional performers	Uniform distribution	6	24
1.2	Operation 2	Depending on small range	The increase in intensity; the use of additional performers	The increase by the end of the operation	4	16
1.3	Operation 3	Independent of increasing resource	Stimulating performers	The eduction by the end of the operation	5	7.5
2	Process 2				15	50
2.1	Operation 4	Independent of increasing resource	Stimulating performers Increasing the intensity of work	The lowest rate in the middle of the operation	8	15
2.2	Operation 5	Depending on small range	Increasing the intensity of work	Uniform distribution	7	35

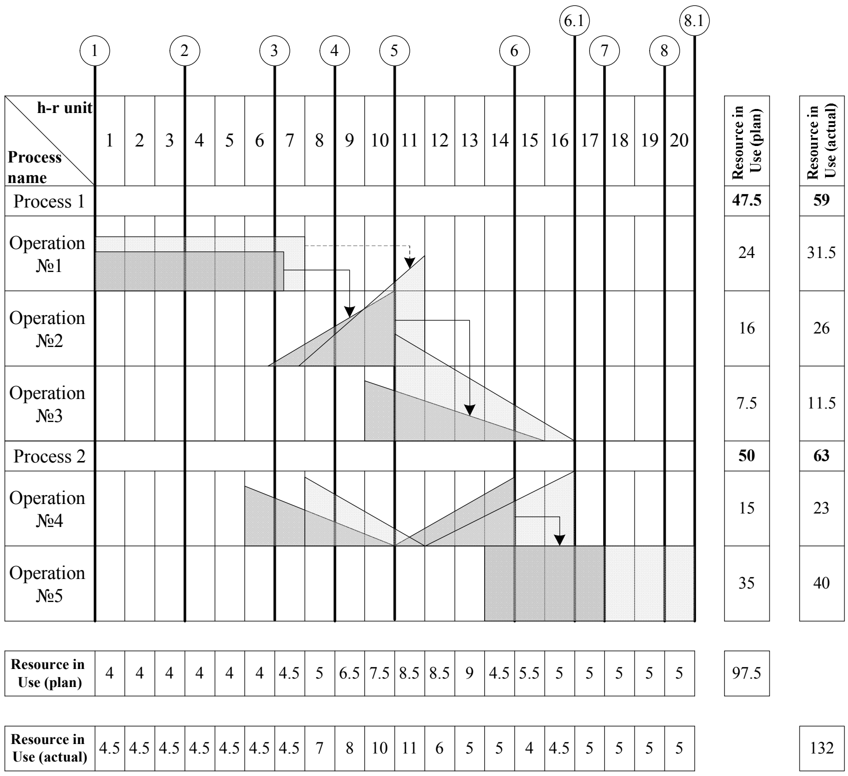

Figure 1. The resource map of decision-making fragment

Table 2.

Efficiency parameters

Time unit	1	2	3	4	5	6	7	8	9	10	11	12	13
Completion factor (plan)	0.04	0.08	0.12	0.16	0.21	0.25	0.29	0.34	0.41	0.49	0.52	0.56	0.59
Completion factor (actual)	0.03	0.07	0.1	0.14	0.17	0.2	0.24	0.29	0.35	0.48	0.51	0.56	0.59
Completion factor on this time range	0.83	0.83	0.83	0.83	0.83	0.83	0.82	0.85	0.86	0.88	0.98	1.0	1.0
Quality %	83	83	83	89	89	89	95	95	92	92	97	97	97
Absolute efficiency	0.69	0.69	0.69	0.74	0.74	0.74	0.78	0.81	0.79	0.81	0.95	0.97	0.98
Relative effectiveness	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.08	0.08	0.03
Time unit	14	15	16	17	18	19	20	21	22	23	24	25	26
Completion factor (plan)	0.64	0.69	0.74	0.79	0.85	0.9	0.95						
Completion factor (actual)	0.63	0.66	0.7	0.75	0.77	0.83	0.85	0.89					
Completion factor on this time range	0.99	0.96	0.94	0.92	0.91	0.9	0.89	0.89					
Quality %	97	97	97	95	91	91	95	95	93	93	93	92	92
Absolute efficiency	0.96	0.95	0.91	0.86	0.83	0.82	0.85	0.84					
Relative efficiency	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.04					

At the Fig.1 we can see that for the actual project works it took more resources than planned, with the quality, to reach the end of each work, is within (tab. 2).

The table 2 shows the necessary parameters to calculate absolute and relative efficiency of decision making. In the first line the time scale from 1 to 26 is given . The second line - the completion factor of the project according to the plan $f_{c(plan)}$, the third line – the completion factor of the actual works $f_{c(actial)}$, the fourth line – the completion factor f_c, the fifth line – the quality factor in percentage, in the sixth line – the absolute efficiency E_a, in the seventh line – the relative efficiency E_r .

Fig. 2 – the planned and actual resources' graph.

Fig. 3 – the relative efficiency of decision making changes. The relative efficiency e_r is marked with the dotted line. This index is the ratio of the planned effect Θ_p to the project fulfillment time:

$$e_r = \frac{\Theta_p}{T_p}, \qquad (8)$$

where e_r – the relative efficiency boundary, Θ_p – planned effect (is taken as a unit).

Analysis of the resulting function allows to determine the importance of the decision to retain project performance within certain limits.

Fig.4. shows the function of absolute efficiency changes , where the dotted line is the border of the absolute efficiency, which in its turn, is equal to a predictable effect.

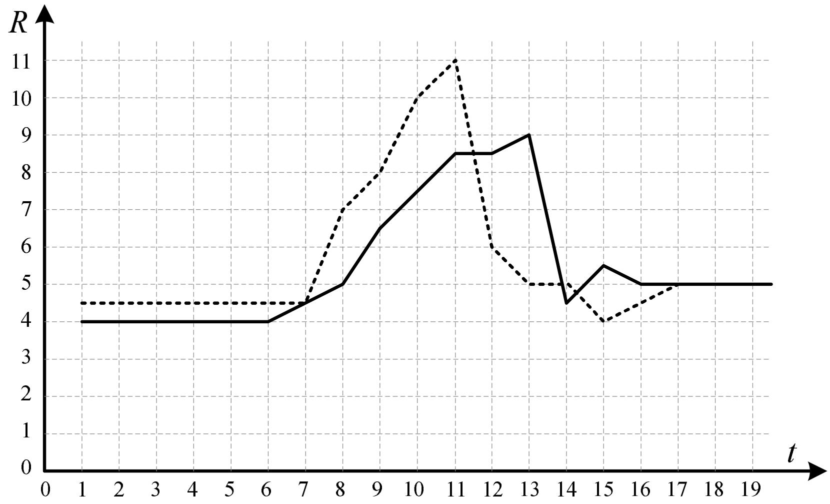

Figure 2. The resource in use graph: as planned – a solid line; under actual use – a dotted line

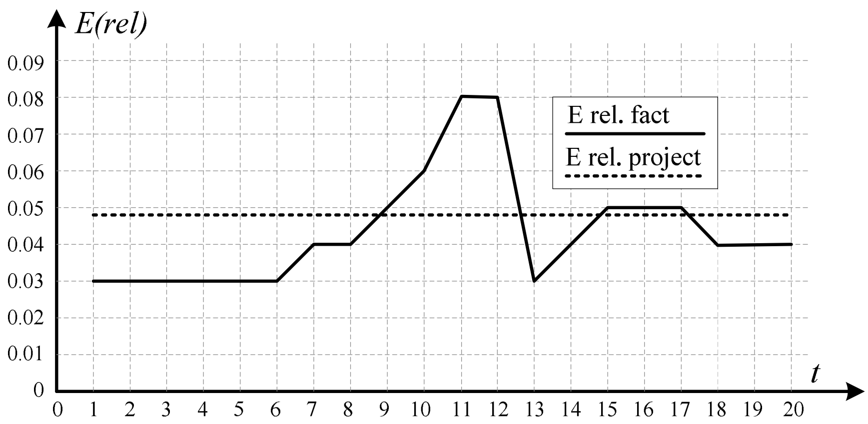

Figure 3. Relative efficiency of design decisions

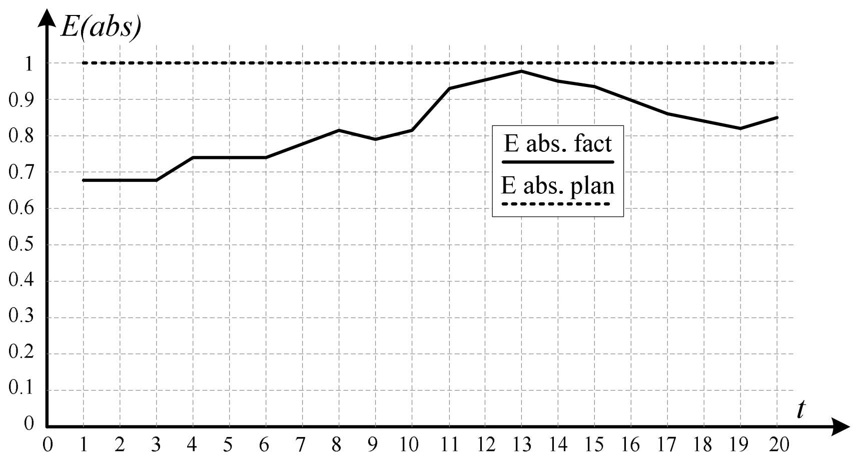

Figure 4. The absolute efficiency design decision performances' graph

As can be seen in Fig. 4, the indicators of absolute efficiency design decisions increase and come nearer to the absolute performances in a certain period of time (in this case from 10 to 13), and then the results decrease with their further growth.

This is due to the following: initially the project manager has boundary data and the imagination of a draft, and only with quantitative and qualitative growth of output data, the solution may be as close to optimum quality of a specific project. But over time, the leader must constantly adjust their actions and decisions as a whole to determine the right approach during the final project result creating.

For the decision making, during the information security systems development, it's necessary a lot of work in the resources analysis to do. These resources are needed for making the right decision to create the optimal information security structure.

When designing information security systems, resources mean the division on types: economic – organizational, labor (labor costs), financial; information (data collection for effective obtain reliable data: individual documents and individual files of documents in libraries, funds, banks and databases, information systems), which in their turn may be network or Internet resources; computing resources and time resources. All this imposes on the process of designing information security systems an additional leverage to take into account certain resources, that must be considered when developing a specific project.

A used resource is determined on the stage of conceptual design project with a prerequisite of design protection (the principle of "golden mean"): the cost of creating information security system should not be more than the value of the information, which this security system protects.

Conclusion

The analysis of the design process of information security has been established, that there is no unitary system of quantitative performances of efficiency of adopted project solution. The formalization of a proposed number of factors has a local character. The proposed technique is general for determining the general evaluating approaches of the effectiveness of information security systems, and partial – to assess the decision-making quality in the assessment methodology of requirements for information security systems [7].

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МЕТОДИКА ОЦІНКИ ЕФЕКТИВНОСТІ ПРОЕКТНИХ РІШЕНЬ ПРИ РОЗРОБЦІ СИСТЕМ ЗАХИСТУ ІНФОРМАЦІЇ НА БАЗІ РЕСУРСНИХ КАРТ

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У статті представлена методика кількісної оцінки ефективності проектних рішень при розробці систем захисту інформації.
Ключові слова: абсолютна ефективність, відносна ефективність, методика, проект, ресурсні карти, системи захисту інформації,ефективність проектного рішення.

МЕТОДИКА ОЦЕНКИ ЭФФЕКТИВНОСТИ ПРОЕКТНЫХ РЕШЕНИЙ ПРИ РАЗРАБОТКЕ СИСТЕМ ЗАЩИТЫ ИНФОРМАЦИИ НА БАЗЕ РЕСУРСНЫХ КАРТ

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В статье представлена методика количественной оценки эффективности проектных решений при разработке систем защиты информации.
Ключевые слова: абсолютная эффективность, методика, проект, оптимальная эффективность, ресурсные карты, система защиты информации, эффективность проектных решений.